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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/733,289	12/08/2000	Xiao-Chun Mu	42390P8875	2980

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EXAMINER

NGUYEN, DILINH P

ART UNIT PAPER NUMBER

2814

DATE MAILED: 07/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/733,289

Applicant(s)

MU ET AL.

Examiner

DiLinh Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 10-17 and 29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 10-17 and 29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 17. 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (U.S. Pat. 6160311) in view of Jimarez et al. (U.S. Pat. 6407334).

Chen et al. disclose a semiconductor device (cover fig.) comprising:

a heat sink 32 (column 3, lines 30-31);

at least one microelectronic die 31 having an active surface and a back surface, wherein at least one microelectronic die back surface adjacent to the heat sink;

a patterned adhesive layer 33 disposed between the die 31 and the heat sink 32;

and

an encapsulation material 36 (column 3, lines 58-59) disposed on the heat sink and the microelectronic die active surface.

Chen et al. fail to disclose the patterned adhesive layer 33 is a patterned thermally conductive adhesive.

Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46. Therefore, it would have been obvious to one having ordinary skill in the art at the

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time the invention was made to modify the device of Chen et al. to increase the heat dissipating between the die and the heat sink, as shown by Jimarez et al.

3. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (U.S. Pat. 6160311) in view of Jimarez et al. (U.S. Pat. 6407334) and further in view of Woodward et al. (U.S. Pat. 4731700).

Chen et al. and Jimarez et al. fail to disclose a microelectronic package core and wherein at least one die is disposed within at least one package core opening.

Woodward et al. disclose a semiconductor device (fig. 2, column 4, lines 12-24) comprising:

a ceramic member 14 having a first surface and an opposing second surface, the ceramic member having at least one opening defined therein extending from the ceramic member first surface to the ceramic member second surface, where the ceramic member second surface abuts the heat sink 12; and

wherein at least one die 16 is disposed within the ceramic member opening and adjacent the heat sink, the die having an active surface. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Chen et al. and Jimarez et al. to provide an electrical crossover in the area above the die and increase in interconnect density, as shown by Woodward et al.

4. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eichelberger (U.S. Pat. 5250843) in view of Jimarez et al. (U.S. Pat. 6407334).

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Eichelberger discloses a semiconductor device (fig. 1, column 13, lines 51 et seq.) comprising:

a heat sink 12 ;

at least one microelectronic die 14 having an active surface and a back surface, wherein at least one microelectronic die back surface adjacent to the heat sink;

a thin die attach material 16 disposed between the die and the heat sink (column 13, lines 64-66); and

an encapsulation material 18 disposed on the heat sink and the die active surface.

Eichelberger fails to disclose a thin die attach material 16 is a patterned thermally conductive adhesive layer.

Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Eichelberger to increase the heat dissipating between the die and the heat sink, as shown by Jimarez et al.

- Regarding claim 2, Eichelberger discloses a build up layer disposed on an upper surface of the encapsulant material.
- Regarding claim 3, Eichelberger discloses the build up layer comprises at least on conductive trace 20 disposed on the encapsulation material upper surface, wherein a portion of the conductive trace extending through the encapsulation material to contact the microelectronic die active surface.

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- Regarding claim 4, Eichelberger discloses the build up layer further includes at least one dielectric layer 24 disposed on at least a portion of the encapsulation material upper surface and at least on conductive trace, and at least one second conductive trace 26 extending through the dielectric layer to contact the conductive trace.

5. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Eichelberger (U.S. Pat. 5250843) in view of Jimarez et al. (U.S. Pat. 6407334) and further in view of Woodward et al. (U.S. Pat. 4731700).

Eichelberger and Jimarez et al. fail to disclose a microelectronic package core and wherein at least one die is disposed within at least one package core opening.

Woodward et al. disclose a semiconductor device (fig. 2, column 4, lines 12-24) comprising:

a ceramic member 14 having a first surface and an opposing second surface, the ceramic member having at least one opening defined therein extending from the ceramic member first surface to the ceramic member second surface, where the ceramic member second surface abuts the heat sink 12; and

wherein at least one die 16 is disposed within the ceramic member opening and adjacent the heat sink, the die having an active surface. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Eichelberger and Jimarez et al. to provide an electrical crossover in the area above the die and increase in interconnect density, as shown by Woodward et al.

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6. Claim 10 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shen (U.S. Pat. 6368894) in view of Woodward et al. (U.S. Pat. 4731700).

Shen discloses a semiconductor device (figs. 1-2, column 4, lines 5 et seq.) comprising:

a heat sink 33 (column 5, lines 27);

a package core 1 having a first surface 10 and an opposing second surface 14, the package core having at least one opening 11 (fig. 2) defined therein extending from the package core first surface to the package core second surface;

at least one die 3 (column 5, lines 30) disposed within at least one package core opening and adjacent the heat sink, at least one die having an active surface; and

an encapsulation material 34 disposed on the die and in portions of at least one package core opening.

Shen fails to disclose where the microelectronic package core second surface abuts the heat sink.

Woodward et al. disclose a semiconductor device (fig. 2, column 4, lines 12-24) comprising: a ceramic member 14 having a first surface and an opposing second surface, wherein the ceramic member second surface abuts a heat sink 12. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shen to provide good heat dissipation for the semiconductor package device, as shown by Woodward et al.

- Regarding claim 15, Woodward et al. disclose a thickness of the ceramic member 14 is greater than a thickness of at least one die 16.

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- Regarding claim 16, Shen discloses the package core is a material selected from the group consisting of ceramics or metals (column 4, lines 5-10).

7. Claims 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shen (U.S. Pat. 6368894) in view of Woodward et al. and further in view of Eichelberger (U.S. Pat. 5250843).

Shen and Woodward et al. fail to disclose a build up layer disposed on an upper surface of the encapsulation material.

Eichelberger discloses a semiconductor device (fig. 1, column 13, lines 51 et seq.) comprising: a build up layer disposed on an upper surface of the encapsulation material 18 to provide interconnection pads (column 10, lines 54-57). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shen and Woodward et al. to provide a direct interconnection between integrated circuit chips of being highly reliable for package device, as shown by Eichelberger.

- Regarding claim 12, Eichelberger discloses the build up layer comprises at least on conductive trace 20 disposed on the encapsulation material upper surface, wherein a portion of the conductive trace extending through the encapsulation material to contact the microelectronic die active surface.
- Regarding claim 13, Eichelberger discloses the build up layer further includes at least one dielectric layer 24 disposed on at least a portion of the encapsulation material upper surface and at least on conductive trace, and at least one second

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conductive trace 26 extending through the dielectric layer to contact the conductive trace.

- Regarding claim 14, Shen discloses the encapsulation (34 and 24) covers the package core first surface.

8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shen (U.S. Pat. 6368894) in view of Woodward et al. and further in view of Jimarez et al. (U.S. Pat. 6407334).

Shen and Woodward et al. fail to disclose a patterned thermally conductive adhesive layer.

Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shen to increase the heat dissipating between the die and the heat sink, as shown by Jimarez et al.

Response to Arguments

Applicant's arguments filed 5/21/03 have been fully considered but they are not persuasive.

- The applicant argues that Chen et al. fail to disclose the patterned adhesive layer 33 is a patterned thermally conductive adhesive.

Examiner agrees that Chen et al. fail to disclose the patterned adhesive layer 33 is a patterned thermally conductive adhesive (please see the office action above).

Therefore, examiner combines the references of Chen et al. to Jimarez et al. because

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Jimarez et al. disclose a patterned thermally conductive adhesive layer 44 (cover fig., column 3, lines 27-28) disposed between the at least one chip 34 and a heat sink 46.

- The applicant argues that Jimarez et al. fail to teach an encapsulation material that is disposed both on the die active surface and the heat sink, as required in claim 1.

Examiner disagrees.

Claim 1 is being unpatentable over Chen et al. in view of Jimarez et al.

Chen et al. disclose the claimed invention including an encapsulation material 36 (cover fig., column 3, lines 58-59) disposed on the heat sink and the microelectronic die active surface. The second reference does not need to disclose all the limitations of the claimed invention. The second reference is combined with the first reference and discloses the limitation(s) that the first reference is missing.

In response to applicant's argument that there is improper and not obvious to combine the references, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

- The applicant argues that Eichelberger's encapsulant 18 is not disposed on the substrate 12, rather, it is disposed on the die attach material 16.

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Examiner disagrees, Eichelberger's encapsulant 18 is not disposed on the die attach material 16 only but the encapsulant 18 is disposed on the heat sink 12 through the die attach material 16; therefore, the encapsulant 18 is disposed on the heat sink 12.

- In response to applicant's argument that there is improper and not obvious to combine the references of Shen to Woodward et al., the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).
- In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case:

Shen discloses a semiconductor device (figs. 1-2, column 4, lines 5 et seq.) comprising:

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a heat sink 33 (column 5, lines 27);

a package core 1 having a first surface 10 and an opposing second surface 14, the package core having at least one opening 11 (fig. 2) defined therein extending from the package core first surface to the package core second surface;

at least one die 3 (column 5, lines 30) disposed within at least one package core opening and adjacent the heat sink, at least one die having an active surface; and

an encapsulation material 34 disposed on the die and in portions of at least one package core opening.

Shen fails to disclose where the microelectronic package core second surface abuts the heat sink.

Woodward et al. disclose a semiconductor device (fig. 2, column 4, lines 12-24) comprising: a ceramic member 14 having a first surface and an opposing second surface, wherein the ceramic member second surface abuts a heat sink 12. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shen to provide good heat dissipation for the semiconductor package device, as shown by Woodward et al.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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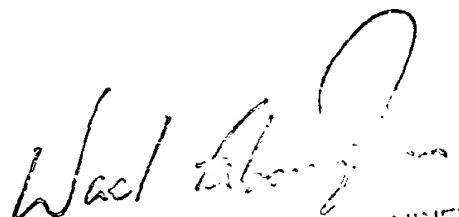
mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DiLinh Nguyen whose telephone number is (703) 305-6983. The examiner can normally be reached on 8:00AM - 6:00PM (M-F).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

DLN
July 16, 2003


SUPERVISORY PRIMARY EXAMINER
TECHNOLOGY CENTER 2800